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Rethinking the Scale, Structure & Scope of U.S. Energy Institutions

Michael H. Dworkin, Roman V. Sidortsov & Benjamin K. Sovacool

Abstract: This essay notes some of the key institutions created in the twentieth century for the purpose of delivering energy in North America. Those institutions are being challenged by a combination of stresses in three interconnected areas: reliability, economics, and environmental sustainability. The essay argues that these three stresses create an “energy trilemma” requiring institutional reform. We suggest that new and modified institutions can best be understood if we evaluate them along three dimensions: institutional scale, structure, and scope. We consider real-world examples of recent institutions in light of each of these dimensions and note both successes and concerns that those factors illuminate. We conclude by noting that some institutional changes will be organic and unplanned; but many others, including responses to climate change, will benefit from conscious attention to scale, structure, and scope by those engaged in designing and building the energy institutions needed in the twenty-first century.

“Men work together,” I told him from the heart,
“Whether they work together or apart.”

– Robert Frost, “The Tuft of Flowers,”
A Boy’s Will (1913)

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People act in many ways. Occasionally we act alone. More often, we act together, because, as Aristotle said, humans are indeed social animals.¹ Some group actions – and most individual ones – have short-lived effects. Other mutual actions are organized, enduring, and extraordinarily effective. These cases usually involve organizations, called *institutions*, that coordinate and maximize the effectiveness of individual actions. Over time, however, institutions often take on their own lives, beyond those of the people acting within them. Eventually, the institutions may be so rooted in past crises that they no longer fit emerging needs. We can see this phenomenon now, in the institutions that our grandparents developed to deal with our nation’s – indeed, our entire continent’s – energy needs.

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In the United States, those institutions were characterized by:

- an energy system with two broad wings, one based on lightly regulated delivery of energy for transportation through liquid fuels, and the other based on closely regulated delivery of even larger amounts of energy in the form of electricity;
- an energy supply for transportation that came to rely on petroleum purchased through international markets – with easy transport on a global scale and an assumption of stable patterns of users and suppliers – supported by major governmental subsidies and preferences, but with price regulation only in the rarest of circumstances;
- an energy supply for light, heat, cooling, and power that is dependent on electric grids combining large, centralized electric power plants with bottleneck transmission systems;
- control systems that coordinated generation and transmission through a pyramidal architecture for the operational control, dispatch, and delivery of power with a primary emphasis on reliability;
- the financing of central-station power plants through long-term bonds, as valued by Wall Street ratings analysts;
- a primary reliance on investor-owned utilities that attracted private investors who expected decades of technological stability to yield long-term, low-risk revenues; and
- a regulatory structure that limited both excessive returns and easy entry of new retail competitors, and that recognized both local and national concerns through state and federal regulatory agencies.

Those functions, and the institutions providing them, worked well (at least for America) in the postwar world of the 1950s and 1960s. They met the fundamental test of “fitness” by matching the scale, scope, and structure of institutions to those of the problems they addressed.²

However, in the decades since then, energy institutions have come under increasingly difficult strains in at least three strategic areas. The first of these is *reliability*, as measured against both accidental and deliberate security challenges. The second is *financial*, with a long-term trend of increasing burdens on gross national product and individual households. And the third is *environmental*, with rising concerns about toxic substances (such as mercury) and the role of energy production as the prime source of the greenhouse gases that are driving global climate change.

Major institutional change will be required to meet the closely interrelated challenges of this “energy trilemma.”³ Some of those changes will arise unexpectedly, without planning and through organic processes that may be painful for us all; others may come more readily if we can think in organized ways about the institutional transformations we expect and desire. In that effort, it is useful to organize our thoughts in terms of the *scale*, *structure*, and *scope* of the ways in which institutions behave.

This will be a decades-long process of “continual improvement” extending far beyond what can be discussed within the bounds of this essay; but to help begin the process, we offer here some examples of both theoretical concepts and practical steps that may be useful. Our suggestions are aimed at the low-hanging fruit: that is, the relationships that already exist and the approaches that have already been adopted in different sectors. In calling them *examples*, we mean to

focus on them as illustrating emergent trends in each area, not as assertions about the many changes that will actually be needed. One example is spatial, dealing with scale; a second is structural, blending public and private enterprises; and the third is jurisdictional, arguing that energy institutions must have the scope to address climate change.

Currently, our energy systems are usually conceived of as multiple entities, each nested within a tidy jurisdictional hierarchy. This is in many ways similar to the “pyramidal structure” of the telecommunications system managed by AT&T from the 1920s until its breakup in the 1970s. The breakup of that system-network architecture was the result of antitrust litigation and consent decrees, but its underlying cause was technological innovation.⁴ When that physical architecture became outmoded, so did the monopolistic control structure. As Peter Huber stated in a 1987 report on the telephone industry:

The old pyramid, with all its mass in the center, is being transformed into a geodesic dome, with a profusion of nodes and links unknown in the older architecture, connected around the outside. AT&T undoubtedly recognized this clearly when it agreed to surrender the heart of its old network for permission to participate fully in building the new one.⁵

The energy sector would benefit from a similarly networked structure, as the slowly emerging architecture of a “distributed network” suggests. As that happens, traditional institutions of control will need radical change or replacements.

Before we delve into the details of how U.S. energy institutions ought to be reformed, we should clarify what we mean by the terms *governance* and *polycentrism*. Governance, broadly considered, refers to how humans make decisions and form

institutions that craft rules shaping behavior. At its most elemental level, governance is about deciding who can do what, who will monitor it, and how rules are modified and changed over time.⁶ The term refers to “any of the myriad processes through which a group of people set and enforce the rules needed to enable that group to achieve desired outcomes.”⁷ Both public and private bodies have created institutions to carry out governance functions. Traditionally these have been nested vertically, with neighborhoods operating below cities, which operate below states/provinces, which operate below national institutions.⁸ Within its scope, and at its scale, each provides a variety of services (such as education, national defense, and administration of a currency).⁹

Although much research and dialogue continues to emphasize what these government actors do, in recent decades scholars have begun to address governance that occurs outside of traditional structures at scales ranging from families and firms to nations and intergovernmental organizations. *Polycentrism* is a term with many meanings. In the context of institutions of governance relating to energy, it describes the concepts identified by the late Nobel laureate Elinor Ostrom. She uses *polycentric* to refer to the self-organization of citizens into multiple authorities at many scales simultaneously.¹⁰ The notion of polycentric governance evolved out of discussions of governance related to public goods, common-pool resources, and collective action problems.

Polycentrism emphasizes that sharing of power among numerous scales of governance must be seamlessly managed, resulting in a “polycentricity” or “nestedness” that involves multiple authorities and overlapping jurisdictions. It can also stipulate that different energy institutions be harmonized to the geographic scale of

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the particular energy problem at hand. This criterion is similar to the “matching principle” in environmental law, which states that governance structures need to be “matched” to the specific type of threat: for instance, pollution of a river would require a governance regime encompassing all states and communities along that river basin; local groundwater threats would by contract need only a governance regime at the city or municipal level.¹¹

When applied to the debate over U.S. energy policy, relying on a polycentric lens has helpful implications regarding the appropriate scale of institutions and their responsibilities. For a problem like collecting data on energy-related pollution from mercury, particulate matter, nitrogen oxide, sulfur dioxide, and carbon dioxide, a national system is far preferable to a local one. It makes little sense to have every state, city, or town measure carbon dioxide emissions, track the carbon intensity of fuels, determine their health effects, identify a safe level of emissions, and design cost-effective policy responses. Such a system is inefficient, and having many pairs of eyes spread across the country is more likely to result in anomalies than if regulation is concentrated in just one location.¹²

However, issues at the scale of electric utilities (which span individual states) and transmission operators should be treated as regional concerns. The best examples here are existing regional transmission operators (RTOs) and independent system operators (ISOs). The Energy Policy Act of 1992 greatly enhanced U.S. electricity *restructuring*, a term that generally refers to the introduction of retail competition and the unbundling of electricity assets into distinct generation, transmission, and distribution entities. Worried about reliability issues, groups of electric utilities pooled together to form RTOs and ISOs to ensure equal

access to the power grid and operate wholesale electricity networks.¹³ Federal Energy Regulatory Commission (FERC) orders 888 and 889 also encouraged the creation of operators such as the Midwest Independent Transmission System Operator and PJM Interconnection. These operators coordinate electricity supply and high-voltage transmission across wide geographic regions to maximize delivery; ensure sufficient reserves and backup power; and enable firms to buy, sell, and trade electricity on spot markets. In an important sense, they provide the vital governance functions for electricity issues that we call “too large for states and too small for a nation.”

Energy issues that correspond to worldwide problems are best treated at the scale of global firms and institutions. Subsidies for fossil fuels are one example, particularly in the transportation sector. Total subsidies are difficult to pin down, but one independent review estimated that in 1999, energy subsidies existed in more than one hundred countries and amounted to a whopping 21.1 percent of all energy prices, in essence subsidizing more than one-fifth of global energy consumption. The reviewers calculated that subsidies for fossil fuels and energy exceeded \$331 billion in 2000 and that subsidies for road transportation amounted to \$1,180 billion – a total of \$1.5 trillion in 2000, or \$1.9 trillion in today’s dollars.¹⁴ At the level of individual states or countries, subsidy reform would be ineffective because the market effects of subsidies from other countries would continue to hide true global energy costs. Climate change presents a similar problem. Individual countries have little incentive to cut emissions without reductions from other countries because those acting first may suffer higher energy costs and may risk losing economic activity to countries without emissions caps.

Another complex energy issue requires forms of polycentric governance that address international maritime regions. For example, Barents 2020 is a joint Norwegian-Russian health, safety, and environmental standards-setting project involving government agencies, oil and gas firms, scientific and research institutions, and nongovernmental organizations (NGOs) across the geographic scope of the Barents Sea. These actors collaborate to harmonize “common acceptable standards for safeguarding people, environment and asset values in the oil and gas industry.”¹⁵ The founders of the project concluded that the optimal way to mitigate the risks and overcome the challenges that are unique to the Barents Sea marine area was to develop standards tailored specifically to the region. They formed an international body that matched in scale the regional problem shared by two nations, and they created rules of conduct for every player – public or private – that operates in the region, regardless of nationality.

At the other end of the scale, polycentric analysis can identify places where local and decentralized action is best. For example, the Renewable Energy and Energy Efficiency Partnership (REEEP) funnels investment into clean-energy projects in the developing world – but only at the local level. Established in 2002 by a collection of regulators, businesses, banks, and NGOs, REEEP works to reduce emissions, improve access to reliable and clean energy in developing countries, and promote energy efficiency. REEEP funds energy-efficiency and renewable-energy projects that have the potential to be widely replicated in many different regulatory frameworks and in a variety of countries and energy markets. The organization receives its funding from governments and a collection of banks, other NGOs, and businesses, primarily

through donations and voluntary contributions.

In the 2008 program year, REEEP partnered with 44 governments, 180 private organizations (such as banks, businesses, and other NGOs), and six multilateral organizations (such as the United Nations). The organization managed a €6.1 million (\$7.8 million) annual operating budget distributed among 145 projects representing a total cumulative investment of €65 million (\$83.4 million), most of which was leveraged from REEEP partners through equity financing. Thirty-seven additional projects were in the works by late 2008 and early 2009. These new projects included the promotion of solar water heaters in Uganda, energy-efficient lighting in India, rural biomass development in China, renewable-energy financing in Mexico, and assessment of the regulatory framework for renewable energy in Argentina.¹⁶

In short, polycentrism suggests that some energy problems are best addressed by neighborhood, city, and state institutions; others by state, regional, and federal institutions. But again, at each scale a multitude of actors must be involved to ensure institutional diversity.

A look at the structure of institutional relationships can help us search for improvements. In recent years, confrontational tones have dominated media coverage of interactions between U.S. energy institutions and the industry. However, that portrayal does not reflect reality. The government has cooperated with the energy industry in a number of ways. In this section, we argue that U.S. energy institutions should do more to recognize, strengthen, and expand the public-private partnership elements of their structures.

Judging by the headlines, the U.S. government seems to be engaged in pervasive conflict with large electrical utilities

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and the fossil fuel industries. Consider the following statement by the President and CEO of the American Petroleum Institute, Jack Gerard:

[The administration] has been restricting oil and natural gas development, leasing less often, shortening lease terms, and going slow on permit approvals – actions which have undermined public support for the administration on energy. It is also increasing or threatening to increase industry's development costs through higher taxes, higher royalty rates, and higher minimum lease bids.¹⁷

Similarly, American Electric Power (AEP), an Ohio-based megacity, dedicated a portion of the “Corporate Citizenship” section of its website to criticism of the Obama administration, particularly the Environmental Protection Agency (EPA).¹⁸ A subsection entitled “What Others Are Saying” contained twenty-two news articles criticizing rules that have been and are being promulgated by the EPA under the Clean Air Act and Clean Water Act.¹⁹ Interestingly, these “others” unanimously agree that the results of the EPA’s recent rule-making will significantly hurt the U.S. economy and lead to the loss of as many as 1.4 million jobs. With sharply worded titles like “Go green, kill jobs” and “The EPA’s War on Jobs,” many of the articles use a militarized tone in expressing support for AEP’s position.

Unsurprisingly, the government sometimes responds in a similar manner. For example, when the oil and gas industries criticized changes in how permits are issued following the BP Deepwater Horizon oil spill, former Director of the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) Michael Bromwich called the industry’s accusations “politically motivated” and “erroneous.”²⁰ EPA Administrator Lisa P. Jackson, who became the primary target of

the large utilities that rely on coal-fired power generation, reacted to mounting criticism of upcoming rules under the Clean Air Act with a strike of her own. “I do very much believe that it’s time for us to get past this tired dance, where folks inside this Beltway get paid a lot of money to say things that aren’t true about public health initiatives that this agency is charged by law with undertaking,” said Jackson in response to pressure from industry lobbying groups.²¹

The point of these examples is not to assess the merits of arguments presented by either side, but rather to highlight the common assertions that government and industry are in conflict with each other.²² However, underlying the appearance of discord is a deeper truth: namely, that public and private energy institutions have a long history of working together. One entire energy sector, the nuclear industry, was conceived, born, and taught to walk in government labs, mines, and naval vessels. The transportation fuels sector relies on the U.S. military presence around the world to ensure reliable transport of oil and gas. Both sectors, like other energy industries, rely heavily on supportive tax policies and governmental grants. Moreover, regulated companies commonly play a major part in shaping the regulations under which they operate.²³

Public-private cooperation on energy issues exists for several reasons. Perhaps the most compelling is that many energy-related technologies have grown so complex that regulators simply cannot keep up with technological advances. Offshore oil and gas exploration and extraction are good examples of such technological advancement. Members of the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling stated in their 2011 report to the president that drilling the Macondo well was “a complex, even dazzling, enterprise.” The

authors also noted: “The remarkable advances that have propelled the move to deepwater drilling merit comparison with exploring outer space.” Unsurprisingly, the commission recommended arming “those in charge of regulatory oversight” with necessary technical expertise.²⁴ Failure to raise a red flag is not the only problem created by a lack of technical know-how. An overly cautious regulator may shut down a promising new technology because she simply does not understand it. For both reasons, the need for technological expertise often presses parties to blur the line between public and private governance of energy projects.

Government and industry cooperate in other ways. Research and development support, government procurement, and energy pilot programs all offer significant benefits to private enterprises. According to the Congressional Budget Office, federal support for developing and producing energy technologies totaled approximately \$24 billion in 2011.²⁵ Federal, state, and municipal governments have large vehicle fleets and real estate inventories, both requiring vast amounts of energy. Governments also have unique needs that at times can be met only with the technologies that have not penetrated the commercial market. For example, many municipalities have switched to natural gas-powered buses. Thus, government procurement and trial programs can accomplish perhaps the hardest task: bringing a shiny prototype through to a commercially scalable product.

Although sharply worded headlines and remarks give the impression that both sides would have to build a relationship from scratch, a legal and regulatory framework for such cooperation already exists. The Administrative Procedure Act (APA) of 1946 sets forth the process for federal agency rule-making, allowing the public – including energy providers – to

use notice-and-comment procedures to influence the regulations to which they might be subject.²⁶

The National Technology Transfer and Advancement Act (NTTAA) of 1995 lays out, among other things, a system of research and development cooperation between the energy industry and the government.²⁷ It also directs federal agencies to use technical standards developed by voluntary consensus standards bodies, except where “inconsistent with applicable law or otherwise impractical.”²⁸ Thus, the NTTAA gives congressional endorsement to the practice of “recruiting” outside authority in developing standards and regulations.²⁹ The Office of Management and Budget (OMB) Circular No. A-119, “Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities,” which clarifies section 12 of the NTTAA, represents yet another endorsement of this cooperative regulatory approach.³⁰ In a 2010 report on voluntary consensus standards and conformity assessment, Mary F. Donaldson of the National Institute of Standards and Technology emphasized the following benefits of private-public partnership in setting standards:

Federal investment in voluntary standards development helps to provide sound technological underpinning to standards, speeds the standards development process, and enables the adoption of VCSs [voluntary consensus standards] to support agency missions. Furthermore, adoption of VCSs for Federal agency use provides cost savings to Federal agencies, the Nation’s businesses, and the taxpayer through reduced injuries and deaths, increased transactional efficiencies, reduced administrative burdens, and lower costs of products and services.³¹

More recently, the Federal Energy Regulatory Commission (FERC) recruited

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industry expertise to address concerns raised by the widespread electricity blackout that occurred in 2003. After the Energy Policy Act of 2005 granted FERC explicit authority to require mandatory standards for reliability in the electric sector, the commission authorized a new institution, the National Electric Reliability Corporation (NERC), to coordinate industry expertise and develop specific reliability standards and sanctions.

In spite of these examples, some may view the possibility of closer cooperation between U.S. energy institutions and the energy industry with skepticism. It is true that when regulators and the regulated are close in every facet of their relationship, the lines between the two begin to blur. Therefore, it is critical for energy institutions to determine whether industry cooperation is appropriate with respect to specific instances, areas, and functions. A case in point is the failure of the Minerals Management Service (MMS) to prevent the BP Deepwater Horizon accident.

The MMS was what the members of the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling called in their Report to the President a “cross-purposes regulator.” This means it was responsible for three distinct and conflicting functions: resource management; revenue collection; and health, safety, and environmental oversight. The authors of the report eloquently captured the biggest structural flaw of the MMS: “From birth, MMS had a built-in incentive to promote offshore drilling in sharp tension with its mandate to ensure safe drilling and environmental protection.” As a result, the agency developed a very close “cooperative” relationship with the industry, the kind that led to one of the worst environmental and economic disasters in the nation’s history. Cooperation relative to safety, however, was virtually nonexistent. “It was like pulling teeth,”

stated a senior MMS employee: “We never got positive cooperation from either industry or the Office of Management and Budget.”³²

The existing legal framework allows government agencies, including energy institutions, to be creative in placing safeguards to prevent the cross-purposes regulator problem. For example, agencies do not always have to follow “the somewhat rudimentary rulemaking provisions of the APA.”³³ Separation of functions among and within U.S. energy institutions and their structural units allows private-public cooperation where it is appropriate and beneficial for both sides. This approach can also block the industry from infiltrating governmental oversight, permitting, and licensing functions and allows agencies, departments, and civil servants to fulfill their missions.

In this section, we have discussed research and development cooperation, commercialization of new technologies, participation in rule-making, and use of industry standards as possible avenues of cooperation between energy institutions and the industry. We also see a place in this kind of cooperation for creative ideas – such as William Pedersen’s “regulatory reform contracts” – provided that governmental institutions can always be distinguished from regulated entities.³⁴ In fact, the energy sector is not the only field in which players can be both governmental and regulated entities at the same time. Consider, for example, the Port Authority of the States of New York and New Jersey or the role of any telecommunications utility exercising eminent domain over the land of others. In the 1982 case *Loretto v. Teleprompter Manhattan CATV Corporation*, the U.S. Supreme Court declared that apartment owners had to be compensated if the state of New York required them to allow cable companies to run wires to their residential apartments. A year later,

on remand, the Court of Appeals held that the economic value of that compensation could be set at a level too low to be worth collecting, typically a token \$1 per building.³⁵

The Barents 2020 project (discussed above) is also instructive. After providing the initial funding, the Norwegian government connected its standardization agencies with the project. It then helped facilitate a coalition consisting of the domestic and international oil and gas industries, research institutions, and NGOs. Finally, the Norwegian government and other Barents 2020 partners persuaded the Russian government, research institutions, and the oil and gas industry to join as well.³⁶ As a result, Norwegian and Russian governments were kept in the loop during the technically challenging standards-setting process. The industry benefited from the scientific expertise of participating research institutions, as well as from the trust it gained from government authorities and NGOs, none of which were separated from the process by closed boardroom doors.

The successes of some public-private cooperation and the potential for new creative ideas are difficult to disregard.³⁷ U.S. energy institutions and the energy industry should continue on the same path, giving increased consideration to the need for transparency and public understanding of each party's complex role.

A third factor, the jurisdictional scope of an institution, is also helpful to consider. A prime example is the historic view of climate change as merely an environmental issue. This outlook has contributed to the failure of decision-makers to recognize and mitigate the phenomenon's economic risks. Such risks are foreseeable and, to some degree, manageable, especially if considered in the context of an institution's goals and responsibilities.

Therefore, it is mandatory that U.S. energy institutions incorporate climate change risks into the scope of their decision-making, fundamentally altering how they weigh economic costs and benefits.

Climate change has been a topic of global public discussion for more than thirty years. However, in the United States, it has gained serious governmental consideration only in the last decade.³⁸ Exxon Mobil, a longtime climate change skeptic, softened its public position in 2007.³⁹ The Regional Greenhouse Gas Initiative (RGGI), the first market-based program designed to decrease greenhouse gas emissions in the United States, held its first auction on September 25, 2008.⁴⁰ There was much public excitement surrounding the Fifteenth Conference of the Parties (COP 15) that took place in Copenhagen in December 2009. There, the U.S. delegation, led by President Obama, played an active role in negotiating the Copenhagen Accord, a political agreement that served as a first step to the post-Kyoto regime.⁴¹ With the Waxman-Markey climate bill pending in Congress, it seemed that the United States was on the verge of significant domestic policy changes.⁴²

Yet those changes never materialized. The climate legislation died in the Senate, and the 2010 midterm elections ended all near-term prospects for its revival in the House of Representatives.⁴³ COP 16 in Cancun, Mexico, and COP 17 in Durban, South Africa, garnered only a fraction of the media coverage that the Copenhagen meeting received. The level of public awareness and concern about climate change dropped as well. Americans now seem less certain than they were a decade ago about the accuracy of global warming news coverage, about humankind's role in causing global warming, and about the scientific consensus on the issue.⁴⁴

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On the other hand, RGGI appears to be weathering the climate change policy “chill” of the early 2010s. It held its sixteenth auction on June 6, 2012.⁴⁵ In terms of our three factors of scale, structure, and scope, RGGI may be a good example of a new institution that is larger than a state but smaller than a nation, is structured by government to channel private investment, and has a scope that includes both environmental and economic considerations.

The fact that climate change is no longer a front-page issue does not mean that the problem itself has ceased to exist. Moreover, the failure to address climate change amplifies potentially grave risks for the struggling U.S. economy. Unfortunately, most Americans do not view climate change as an economic issue. In fact, Gallup poll analysis of the “Most Important Problem” facing the nation does not list climate change as an economic issue.⁴⁶ The historic perception of climate change as a predominately environmental issue has slowed the response to the problem.⁴⁷ The framing of climate change as an environmental, rather than an energy, priority is also tied to the fact that it was meteorologists, climatologists, and environmental scientists who first sounded the alarm.⁴⁸ In addition, calls for climate change mitigation, or even mere acknowledgment of the problem, are often labeled “radical environmentalism” by conservative politicians.⁴⁹

Early attempts to reclassify climate change as something more than an environmental issue were made in the early 2000s. In the 2003 Pentagon report “An Abrupt Climate Change Scenario and Its Implications for United States National Security,” authors Peter Schwartz and Doug Randall described the national security threats posed by rapid climate change.⁵⁰ British economist Nicholas Stern released the most comprehensive

analysis of the economic impacts of climate change, the *Stern Review on the Economics of Climate Change*, in October 2006.⁵¹ The Stern Review noted that the economic cost of inaction can range from 5 percent to 20 percent of global GDP per year.⁵² By contrast, the cost of reducing greenhouse gas emissions and avoiding related economic damage is estimated to be around 1 percent of global GDP.⁵³ According to the report, the risks of catastrophic damage can be significantly decreased if atmospheric greenhouse gas levels are stabilized between 450 and 550 ppm of CO₂ equivalent.⁵⁴

Unfortunately, the Stern Review’s recommendations have not been taken seriously in most sectors of the U.S. economy, including the energy sector. Because the energy sector is the economy’s driving force, failure to take into account the economic implications of climate change may lead to dire consequences, not only for the sector itself, but for the entire economy.

Expanding the scope of institutional concerns turns a debate over sea-level rise into a conversation about the economic risk of allowing the construction of large power plants near the coastline. This shift in perspective converts the high costs and uncertain benefits of mitigating climate change into the manageable costs of mitigating climate change risks and the palpable benefits of avoiding foreseeable economic, social, and environmental damage. Therefore, by bringing the economic risks of climate change into the scope of factors that an energy institution should consider, the scale of the problem can be adjusted to fit the scale of the institution. This shift in perspective also has the potential to humanize the impacts of climate change, making them more visible and visceral. The previously abstract notion of “populations occupying low-lying coastlines” becomes indigenous communities struggling with the intru-

sion of saltwater in their wells; similarly, “percentage of GDP lost” becomes minority shop owners in New Jersey and New York repairing hurricane-damaged boardwalks, and “displaced populations” becomes tribal refugees in the Maldives relocating their homes to higher ground.

It may be an interesting and intellectually challenging exercise for economists to dissect the aggressive assumptions made by the authors of the Stern Review.⁵⁵ After all, environmental economists William Nordhaus and Robert O. Mendelsohn somewhat infamously critiqued certain aspects of its methods concerning discounting,⁵⁶ demographics, extreme weather, and equity.⁵⁷ However, it is simply imprudent for U.S. energy institutions to ignore the economic risks noted in the report in relation to the energy subsector, even if those risks cannot be precisely known or forecasted by economic models.

Treating climate change from the standpoint of risk assessment has been embraced by the U.S. Navy and the insurance industry, entities that cannot be described as “radically environmental,” even by conservative pundits. In May 2010, the Department of the Navy released the “U.S. Navy Climate Change Roadmap.”⁵⁸ In the opening paragraph of their report, the members of Task Force Climate Change unambiguously stated the rationale for preparing the roadmap:

Climate change is a national security challenge with strategic implications for the Navy. Climate change will lead to increased tensions in nations with weak economies and political institutions. While climate change alone is not likely to lead to future conflict, it may be a contributing factor. Climate change is affecting, and will continue to affect, U.S. military installations and access to natural resources worldwide. It will affect the type, scope, and location of future Navy missions.⁵⁹

The roadmap identifies the following focus areas for incorporating climate change considerations: 1) strategy, policy, and plans; 2) operations and training; 3) investments in capability and infrastructure; 4) strategic communications and outreach; and 5) environmental assessment and prediction. The final focus area is especially noteworthy, as it lays out the basis for incorporating climate change considerations into the scope of the U.S. Navy’s decision-making process. The goal of the roadmap is “[t]o provide Navy leadership and decision makers a science-based, comprehensive understanding of the timing, severity, and impact of current and predicted global environmental change on tactical, operational, and strategic (climatic) scales.”⁶⁰

For their part, insurance companies assess risk for a living. They, too, believe that the scope of climate change is larger than an environmental concern. Among the first private enterprises to place serious emphasis on the economic risks posed by climate change, many insurance companies no longer rely on individual efforts to grapple with climate change risks; they have joined the industry-wide movement ClimateWise.⁶¹ Established in 2007 by the Prince of Wales, ClimateWise now has more than forty members, including insurance giants such as Allianz, Aviva, Lloyd’s, Swiss Re, and Zurich.⁶² Chairman John Coomber, a member of the Swiss Re’s board, captured the essence of the ClimateWise mission in the following statement:

Insurers everywhere should be using our industry’s core expertise to better understand and communicate the risks climate change poses to our economic and social systems and to forge and promote solutions to bring those risks down to an acceptable level. This independent review demonstrates that insurers across the

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world are indeed actively playing this role in a variety of ways.⁶³

By joining ClimateWise, members commit to the following principles. They must 1) lead in risk analysis, 2) inform public policy-making, 3) support climate awareness among customers, 4) incorporate climate change into investment strategies, 5) reduce the environmental impact of their own businesses, and 6) report and be accountable.⁶⁴ The participating insurers may act individually or collectively to “reduce the economy’s and society’s long-term risk from climate change, within the confines of a competitive market.”⁶⁵

Despite the obvious differences in each entity’s reasons for incorporating climate change risks into their decision-making processes, U.S. energy institutions have much in common with the U.S. Navy and the insurance industry. Large coal-fired and nuclear power plants, oil pipelines, and unexplored offshore oil and gas fields are capital-intensive investments. They are economically attractive only if construction costs can be spread over time and reduced to competitive levels through the use of long-term financings such as thirty-year bonds; to appreciate this issue, imagine the rate effect of recovering the full cost of a \$5 billion power plant in ten years of 10 percent annual depreciation, rather than with thirty-plus years of 3 percent annual depreciation. However, spreading cost recovery over a thirty-year period is rational only if one is sure that neither fundamental climate, nor basic fuels, nor regulatory requirements, nor access to huge quantities of water will become problematic during those decades. Utilities may be willing to gamble on those expectations, but their investors are unlikely to do so.

Therefore, just as the U.S. Navy believes that climate change implications will compromise its ability to protect national

security, U.S. energy institutions should view climate change as a threat to their mission of ensuring a reliable energy supply. Similarly, as the insurance industry works to protect investments that can be susceptible to the economic risks posed by climate change, U.S. energy institutions should work to protect their customers – and American society at large – from investing in energy projects and technologies that will become obsolete in the face of a changing climate.

It is encouraging to see more calls for incorporating climate change risk into the scope of energy decision-making. In the last two years, Ceres, a promoter of sustainable business practices, has issued a series of reports targeting climate change risks in connection with the energy sector.⁶⁶ One recent report, “Practicing Risk-Aware Electricity Regulation: What Every State Regulator Needs to Know,” is particularly noteworthy. It provides an overview of risks associated with investment in energy infrastructure, discusses the regulatory challenges of managing such risks, and outlines seven critical strategies for making risk-aware regulatory decisions. The report captures the message of this essay: U.S. energy institutions need to include climate change risks in the scope of their decision-making process; and moreover, this must be done now in order to avoid economic losses in the near future.⁶⁷

We began by noting some of the key institutions created in the twentieth century for the purpose of delivering energy throughout North America. We observed that these institutions are being challenged by a combination of stresses in three areas: reliability, economics, and environmental sustainability. As we have suggested, the institutional reforms needed to address this energy trilemma can best be

understood in terms of the scale, structure, and scope of new and modified institutions. In considering real-world examples of recently formed institutions, we have noted both successes and concerns that these three factors illustrate.

In particular, issues of scale will increasingly call for polycentric organizations that interlace multiple interests rather than operate in simple hierarchies. Thus, polycentrism offers a way forward, a way to connect the different levels, and a way to use the level of the household and the local community to find solutions to regional and international challenges. Issues of structure will require cooperation between public and private sectors, signaling an increasing need to clarify the distinctions between those sectors. Issues of scope help explain both the failure of the energy sector's responses to climate change and the need to face that challenge.

The social science research cited above can help explain and improve the delivery of energy services; indeed, there is real value in further research on these topics. For a century or more, societies like ours have treated social and technical

issues as fundamentally different. The costs of doing so have been profound, as C. P. Snow illustrates in *The Two Cultures and a Second Look* (1959).⁶⁸ Conversely, the benefits of bridging the gap between Lord Snow's two cultures may be vital. In pragmatic terms, key energy institutions are hiring behavioral analysts to predict and identify the factors that drive such things as energy demand, public responses to siting proposals, and climate change denial.⁶⁹ Similarly, the conceptual work of Carnegie Mellon University's program on Engineering and Public Policy is starting to produce helpful insights into behavioral responses to new energy policies.

Some institutional changes will be organic and unplanned, but many others will benefit from conscious attention to scale, structure, and scope by those engaged in designing and building the energy institutions that the twenty-first century needs. Those who are "present at the creation"⁷⁰ of energy institutions for a new energy world will do well to use those concepts consciously as they face the age-old tasks of "fitting" institutions to technological realities and of looking to the social sciences for guidance.

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ENDNOTES

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- ¹ Aristotle, *Politics*, I.
- ² For a seminal use of the concept of *fitness*, see Stephen Breyer, *Regulation and its Reform* (Cambridge, Mass.: Harvard University Press, 1982). In that book, Breyer, then a professor of law and now a Justice of the U.S. Supreme Court, argues that regulation itself is inherently neither good nor bad, but that its merits turn on "regulatory fit": that is, a match between social problems and the response of regulatory institutions.
- ³ Use of the term *energy trilemma* is increasing. The earliest public use of which we are aware was in a 2005 series of lectures by Michael Dworkin. The term first appeared in a published article three years later; see John A. Sautter, James Landis, and Michael H. Dworkin, "The Energy Trilemma in the Green Mountain State: An Analysis of Vermont's Energy Challenges and Policy Options," *Vermont Journal of Environmental Law* 10 (2008–2009): 477.
- ⁴ For an overview of recent patterns of institutional change caused by technological change, see Debora L. Spar, *Ruling the Waves: Cycles of Discovery, Chaos, and Wealth from the Compass to the Internet* (New York: Harcourt, 2001).
- ⁵ Peter Huber, *The Geodesic Network: 1987 Report on Competition in the Telephone Industry* (Washington, D.C.: U.S. Department of Justice, January 1987).
- ⁶ Elinor Ostrom, "Polycentric Systems for Coping with Collective Action and Global Environmental Change," *Global Environmental Change* 20 (2010): 550–557.
- ⁷ Ann E. Florini and Benjamin K. Sovacool, "Who Governs Energy? The Challenges Facing Global Energy Governance," *Energy Policy* 37 (12) (December 2009): 5239–5248. See also Ann E. Florini and Benjamin K. Sovacool, "Bridging the Gaps in Global Energy Governance," *Global Governance* 17 (1) (January–March 2011): 57–74.
- ⁸ In theory, international entities can be seen as one hierarchical rank up from nation-states. In practice, however, no body larger than a nation-state—neither the Papacy, nor the Comintern, nor the United Nations—has imposed its will on those beneath in ways that match the sustained and detailed impact that nation-states have had since their seventeenth-century origins in the Westphalian system (which invoked the concept of nation-states to end Europe's Wars of Religion).
- ⁹ Benjamin K. Sovacool, "An International Comparison of Four Polycentric Approaches to Climate and Energy Governance," *Energy Policy* 39 (6) (2011): 3832–3844.
- ¹⁰ Ostrom, "Polycentric Systems for Coping with Collective Action and Global Environmental Change."
- ¹¹ Timothy Doyle and Brian Doherty, "Green Public Spheres and the Green Governance State: The Politics of Emancipation and Ecological Conditionality," *Environmental Politics* 15 (5) (November 2006): 881–892.
- ¹² Daniel C. Esty, "Revitalizing Environmental Federalism," *Michigan Law Review* 95 (December 1996): 560.
- ¹³ The body of literature discussing RTOs and ISOs is large, complex, and often contradictory. For a discussion focused on governance issues, see Michael H. Dworkin and Rachel Aslin

Goldwasser, "Ensuring Consideration of the Public Interest in the Governance and Accountability of Regional Transmission Organizations," *Energy Law Journal* 28 (November 1998): 543.

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¹⁴ Norman Myers and Jennifer Kent, *Perverse Subsidies: How Tax Dollars Can Undercut the Environment and the Economy* (Washington, D.C.: Island Press, 2001).

¹⁵ *Barents 2020: Assessment of International Standards for Safe Exploration, Production and Transportation of Oil and Gas in the Barents Sea*, Final Report no. 2009-1626 (2009), 11.

¹⁶ Florini and Sovacool, "Who Governs Energy?"

¹⁷ http://www.pennenergy.com/index/petroleum/display/6705820362/articles/pennenergy/petroleum/exploration/2012/may/api-says_administration.html?cmpid=EnlDailyPetroMay172012&cmpid=EnlWeeklyPetroMay182012.

¹⁸ See <http://www.aep.com/environmental/NewEPARules/>. The EPA statutes criticized by AEP include the Cross-State Air Pollutants Rule (CSAPR), the Regional Haze Program, the Hazardous Air Pollutants (HAPs) Rule, the Coal Combustion Residuals (CCR) Rule, and Section 316(b) of the Clean Water Act.

¹⁹ The section "What Others Are Saying," which appeared on AEP's website (<http://www.aep.com>) as of July 4, 2012, has since been removed.

²⁰ BOEMRE served as an "interim" agency in the process of reorganizing the former Minerals Management Service (MMS). After the Deepwater disaster, the MMS was broken into two separate agencies, the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE). As the titles of the newly formed agencies suggest, the BOEM is charged with offshore resource management, whereas the BSEE is responsible for health, safety, and environmental oversight. Bromwich was appointed in June 2010 to orchestrate the reorganization. See "BOEMRE Director Delivers Final Speech Before Agency Reorganization," press release (Washington, D.C.: Bureau of Ocean Energy Management, Regulation and Enforcement, September 13, 2011), sec. 1 and 3.

²¹ Darren Samuelson, "The Environmental Protection Agency's Lisa Jackson Swings Back at Critics," *Politico*, October 6, 2010, <http://www.politico.com/news/stories/1010/43168.html>.

²² Bromwich made a convincing case in support of his response using data and real-life examples. See "BOEMRE Director Delivers Final Speech Before Agency Reorganization," sec. 3 and 4. For an assessment of the recent EPA regulations, see also James E. McCarthy and Claudia Copeland, *EPA Regulations: Too Much, Too Little, or On Track?* (Washington, D.C.: Congressional Research Service, April 25, 2012), <http://www.fas.org/sgp/crs/misc/R41561.pdf>.

²³ Jody Freeman, "The Private Role in Public Governance," *New York University Law Review* 75 (2000): 543, 639.

²⁴ National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling – Report to the President* (Washington, D.C.: Government Printing Office, 2011), vii – viii.

²⁵ Note that approximately \$20.5 billion came in the form of tax subsidies and the remaining \$3.5 billion in the form of direct spending. See Congressional Budget Office, <http://www.cbo.gov/publication/43040>.

²⁶ Public Law 79-404.

²⁷ Public Law 104-113, sec. 2.

²⁸ *Ibid.*, sec. 12(d).

²⁹ Freeman, "The Private Role in Public Governance," 640. Government agencies use industry standards in a number of ways. For example, an agency may adopt a standard as part of a rule, use it as a basis for rule-making, or show strong deference to a standard. See <http://standards.gov/regulations.cfm>.

- ³⁰ As of this writing, OMB Circular No. A-119 is being revised to conform the Circular's terminology to the NTTAA and to increase its clarity and effectiveness. See http://www.whitehouse.gov/omb/fedreg_a119rev.
- ³¹ Mary F. Donaldson, *Thirteenth Annual Report on Federal Agency Use of Voluntary Consensus Standards and Conformity Assessment* (Washington, D.C.: National Institute of Standards and Technology, U.S. Department of Congress, August 2010), http://standards.gov/nttaa/resources/nttaa_ar_2009.pdf.
- ³² National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *Deep Water*, 55–57, 72, 76–78.
- ³³ William F. Pedersen, Jr., "The Decline of Separation of Functions in Regulatory Agencies," *Virginia Law Review* 64 (1978): 991, 1016. Note that courts, practitioners, and legal scholars have grappled with the interpretation of Section 5(c) of the APA on the "Separation of Functions" since the act was passed in 1946. See generally Kenneth Culp Davis, "Separation of Functions in Administrative Agencies," part 2, *Harvard Law Review* 61 (1948): 612.
- ³⁴ See, for example, William F. Pedersen, Jr., "Contracting with the Regulated for Better Regulations," *Administrative Law Review* 53 (2001): 1067, 1071.
- ³⁵ 458 U.S. 419 (1982); 446 N.E. 2d 428 (N.Y. 1983).
- ³⁶ *Barents* 2020, 11, 12.
- ³⁷ For example, the recently promulgated Safety and Environmental Management Systems (SEMS) rules incorporate by reference the American Petroleum Institute's Recommended Practice for Development of a Safety and Environmental Management Program for Offshore Operations and Facilities (API RP 75).
- ³⁸ David Hunter, James Salzman, and Durwood Zaelke, *International Environmental Law and Policy*, 3rd ed. (New York: Foundation Press, 2007), 632.
- ³⁹ In fact, Exxon Mobil was the last oil supermajor to do so. See Rick Pilz, "Exxon Mobil Takes First Steps to Accept Climate Change Science and Cut Funding of the Denial Machine," *Climate Science Watch*, January 22, 2007, <http://www.climatewatch.org/2007/01/22/exxon-mobil-takes-first-steps-to-accept-climate-change-science-and-cut-funding-of-the-denial-machine/>.
- ⁴⁰ http://www.rggi.org/market/co2_auctions/information/old_auction_notices.
- ⁴¹ "Post Copenhagen Outlook: Discussion with Jonathan Pershing, U.S. Deputy Envoy for Climate Change," Center for International and Strategic Studies, January 14, 2010, <http://csis.org/event/post-copenhagen-outlook>.
- ⁴² H.R. 2454, 111th Cong. (2009–2010); American Clean Energy and Security Act of 2009, <http://www.govtrack.us/congress/bill.xpd?bill=h111-2454> (accessed June 21, 2011).
- ⁴³ *Ibid.*
- ⁴⁴ <http://www.gallup.com/poll/153608/Global-Warming-Views-Steady-Despite-Warm-Winter.aspx>.
- ⁴⁵ The clearing price for a short ton of CO₂ has decreased from \$3.07 at the first auction to \$1.93 at the sixteenth auction. See http://www.rggi.org/market/co2_auctions/results.
- ⁴⁶ See <http://www.gallup.com/poll/1675/most-important-problem.aspx>. Note that climate change does not appear on this list at all. The closest match, "Environment/pollution," is listed as a non-economic problem.
- ⁴⁷ *Ibid.*
- ⁴⁸ The First World Climate Conference was organized by the World Meteorological Organization in 1979; Hunter et al., *International Environmental Law and Policy*, 667.

- ⁴⁹ See, for instance, <http://www.ricksantorum.com/news/2012/03/newt-and-nancy-needed-bigger-couch>.
- ⁵⁰ Peter Schwartz and Doug Randall, “An Abrupt Climate Change Scenario and Its Implications for United States National Security,” report prepared by the Global Business Network for the Department of Defense, October 2003.
- ⁵¹ “Publication of the *Stern Review on the Economics of Climate Change*” (London: The National Archives, HM Treasury, October 30, 2006), http://webarchive.nationalarchives.gov.uk/+http://www.hm-treasury.gov.uk/press_stern_o6.htm.
- ⁵² Nicholas Stern, *Stern Review: The Economics of Climate Change*, prepublication draft (London: The Nation Archives, HM Treasury, October 2006), vii.
- ⁵³ Ibid.
- ⁵⁴ Ibid., viii.
- ⁵⁵ See generally, William Nordhaus, “The Stern Review on the Economics of Climate Change,” white paper, May 3, 2007, http://nordhaus.econ.yale.edu/stern_o50307.pdf.
- ⁵⁶ Ibid., 9; Robert O. Mendelsohn, “A Critique of the Stern Report,” *Regulation* 29 (4) (Winter 2006–2007): 42–46.
- ⁵⁷ Mendelsohn, “A Critique of the Stern Report,” 42, 44.
- ⁵⁸ Admiral J. W. Greenert, “Navy Climate Change Roadmap,” memorandum for distribution, May 21, 2010.
- ⁵⁹ Task Force Climate Change, “U.S. Navy Climate Change Roadmap” (Washington, D.C.: Department of the Navy, April 2010), 3, <http://www.navy.mil/navydata/documents/CCR.pdf>.
- ⁶⁰ Ibid., 3, 16.
- ⁶¹ <http://www.climatewise.org.uk/about/>.
- ⁶² <http://www.climatewise.org.uk/members/>.
- ⁶³ *ClimateWise Principles: The Fourth Independent Review 2011* (London: PricewaterhouseCoopers LLP and ClimateWise, 2011), 3, <http://www.climatewise.org.uk/storage/fourth-year-review-2011/ClimateWise%20Fourth%20Year%20Review%20-%20Summary%20Version.pdf>.
- ⁶⁴ Ibid., 4.
- ⁶⁵ Ibid.
- ⁶⁶ <http://www.ceres.org/resources/reports>.
- ⁶⁷ See Ronald J. Binz et al., “Practicing Risk-Aware Electricity Regulation: What Every State Regulator Needs to Know” (Boston: Ceres, April 2012), 1, 5, 31.
- ⁶⁸ C. P. Snow, *The Two Cultures and a Second Look* (Cambridge: Cambridge University Press, 1959).
- ⁶⁹ This observation is based on Michael Dworkin’s personal experience as a member of the Boards of Directors of the American Council for an Energy-Efficient Economy and of the Electric Power Research Institute.
- ⁷⁰ The phrase is borrowed from former U.S. Secretary of State Dean Acheson, who used it to describe the conscious creation of institutions (such as the United Nations, NATO, the International Monetary Fund, the World Trade Organization, and the World Bank) that aided U.S. policy for a half-century following World War II. See Dean Acheson, *Present at the Creation: My Years in the State Department* (New York: Norton, 1969). Acheson received the 1970 Pulitzer Prize in History for his book.

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